**MEMORANDUM**

**TO:** The ICCR Coordinating Committee
**FROM:** Fred Porter
**DATE:** July 17, 1998
**SUBJECT:** WORK GROUP TEST RECOMMENDATIONS

At the April 28-29, 1998, Coordinating Committee (CC) work group testing recommendations were discussed, and the CC requested that the work groups flesh-out their test plans by the July CC meeting. Specifically, the work group stakeholder and EPA Co-chairs were to work together compile their tests recommendation information in a common format for presentation before the CC members.

Since the April CC meeting, there have been two teleconferences involving the Co-Chairs to discuss a template to use for compiling the test recommendations and procedures for compiling the recommendations. It was agreed that a template similar to that already in use by the Incinerator Work Group would be used, but with several modifications to make it more responsive to the informational needs voiced by the CC members at the April meeting. Additionally, it was agreed that the test recommendation templates would be compiled in a single document and posted in time for the July CC meeting.

This memorandum transmits the work group test recommendation templates. Attached, in the following order, are test recommendation templates from the following work groups:

- Boiler Work Group (one template)
- Combustion Turbines Work Group (one template)
- Incinerator Work Group (four templates)
- Reciprocating Internal Combustion Engines Work Group (one template)

The Process Heater Work Group did not submit a test recommendation template because it has not developed a test plan. The attachment contains a total of 22 pages.

**SOURCE WORK GROUP NAME:** Boiler Work Group (BWG)

**SOURCES/SUBCATEGORIES TO BE TESTED:** Boilers firing non-fossil materials, such as tires and sludge, particularly those co-firing with wood and/or coal.

**PURPOSE & NEED FOR TESTING:** The BWG recommends a 2-phase test plan. Phase I would focus on materials testing and emissions testing to fill in obvious data gaps. Phase II would fill in remaining data gaps.

**Phase I: Materials testing-** The ICCR boiler databases indicate very little information are available on non-fossil materials. Therefore, it is difficult to determine whether some non-fossil materials are similar and can be grouped together and it is also difficult to determine what HAPs may be emitted from some of the non-fossil materials. Materials testing will be used to: characterize non-fossil materials with the goals being to group similar materials together; help prioritize materials and HAPs for further emissions testing; and help identify what control strategies may be feasible based on the material composition and pollutants they could emit. Another result would be that limited emissions data on non-fossil materials may be used to characterize emissions for materials where information is lacking.

**Phase I: Emission testing-** A review of the ICCR boiler emissions database, test reports expected from ICR requests, and a literature search for emissions and materials information indicated that there are significant data gaps in emissions data for HAPs of interest and Section 129 pollutants from boilers that co-fire various non-fossil materials with primary fuels (wood or coal). The most prevalent and representative types of non-fossil co-fired boilers for which HAP and Section 129 pollutant emission data are lacking are industrial sludges and tires co-fired with wood. Data on the effects on emissions of co-firing different percentages of these materials are lacking. Such data are needed to determine into which of the current subcategories co-fired boilers should be placed (i.e. classified by primary fuel or in a non-fossil subcategory) and to characterize emissions and develop emission standards that will apply to non-fossil co-fired units. Emission data are also lacking on the effects of co-firing various percentages of wood and coal, which is a common practice. Therefore, the phase I emission test will focus on collecting data on non-fossil materials (sludges and tires) co-fired with wood at varying percentages and on co-firing of coal and wood at varying percentages.

**Phase II: Emissions testing**- The phase II emissions testing is meant to: (1) fill data gaps on emissions from fuel/wastes and/or boiler subcategories for which there are little or no emissions data; (2) establish performance of control techniques, i.e., fill data gaps on control device performance and impact of combustion control techniques (GCP) on emissions; (3) understand the effects of operating parameters on emissions and (4) fill data gaps on interaction between criteria pollutants and HAP emissions.

**SUMMARY OF CURRENTLY AVAILABLE TEST DATA:** Version 3 of the boiler emissions database contains test data from 183 emission reports. Only 45 reports are currently in the database for boilers burning non-fossil non-wood materials. The reports are limited to a few materials burned, mostly landfill gas and industrial sludge. Of these, 20 reports are for boilers solely burning a non-fossil material (mostly landfill gas), and 16 reports are for boilers co-firing non-fossil materials with wood or coal. The BWG has developed a materials database that contains information on fuel/waste characteristics for a large number of materials. Materials where information is lacking are listed in the "Description of Combustion Units and Materials to be Tested, Phase I: Materials testing".

**DATA GAPS TESTING WOULD FILL:** See purpose and needs section

**ALTERNATIVES TO TESTING:** If emissions testing is not conducted, EPA will rely on the materials analysis to place boilers in subcategories, but the placement of co-fired units will be questionable. EPA will also rely on the limited emission tests for non-fossil boilers to characterize emissions from all non-fossil materials burned. If materials testing is not conducted, EPA will rely on existing information to place boilers firing various materials into subcategories, but data for some materials is lacking so the placement will be uncertain. The BWG has already investigated several other sources of materials analysis data and several data gaps remain.

**DESCRIPTION OF COMBUSTION UNITS AND MATERIALS TO BE TESTED:**

**Phase I: Materials testing-** Coke plant liquids, tall oils and turpentines, waste activated biological sludge from brewery wastes, wastewater treatment sludges from various industries, waste paper from printing, rice hulls, shells, and corn stalks. Also mil-spec coatings and automotive body coatings for the Incinerator Work Group.

**Phase I: Emissions testing-** A representative boiler (stoker) co-firing sludge and or/ tires with wood and/or coal at various percentages.

**Phase II: Emissions-**See "Number of Combustion Units and Tests, Phase II: Emissions Testing".

**NUMBER OF COMBUSTION UNITS AND TESTS:**

**Phase I: Materials testing-**Samples would be collected from 31 facilities (approximately 3 samples per material to be tested)

**Phase I: Emissions testing-** The test would be conducted on one representative boiler and would consist of 3 test runs under each of several conditions, for example:

- Firing primary fuel (wood) alone under representative operating conditions
- Firing wood with sludge at 2 or 3 different percentages (up to 30% sludge if possible)

- Firing wood with tires at 2 or 3 different percentages (up to 25 or 30% tires if possible)
- Firing wood with waste oil at a low percentage, if the test site burns waste oil
- Firing coal with wood at 3 different percentages, if the test site can fire coal

All of the above conditions would include control device inlet and outlet testing

**Phase II: Emissions testing**- If a single facility that can accommodate the material combinations listed above is not found during phase I, we will test a second boiler during phase II to collect remaining data.

Additional emission test needs are being determined, and may depend on the results of Phase I testing and review of test data currently being submitted by ICR respondents. Potential tests include:

- Testing a representative boiler co-firing another type of non-fossil material (3 test conditions).

- Test a representative boiler with GCP under different operating conditions, for example, 3 load levels and 3 air/fuel ratios.

- Test a representative boiler with a control technique or control combination not tested during phase I for which data are lacking. (Preliminary MACT control options for non-fossil section 129 subcategories include ESP or FF for metal HAPs, scrubbers for inorganic HAPs, and GCP for organic HAPs. Preliminary floors and control options for section 112 materials are under development. The control to be tested will be determined after the BWG completes identification of control options, reviews data on control performance being submitted by survey respondents and BWG members).

**POLLUTANTS TO BE TESTED/ANALYSES TO BE CONDUCTED:**

**Phase I Materials testing:** ultimate; metals in fuel; heat content; moisture content; total halogens; organics; particle size (for solids); viscosity (for liquids); specific gravity (for liquids); and bottoms, sediment, and water (for liquids).

**Phase I and Phase II Emission testing:** Section 129 pollutants (PM, CO, $NO_x$, $SO_2$, HCl, lead cadmium, mercury, dioxins/furans), additional metals (e.g., antimony, arsenic, beryllium, chromium, manganese, and nickel), PAH, PCBs, benzene, formaldehyde, and radionuclides (during coal co-fired runs only)

**LEVERAGING OF RESOURCES:** To reduce the number of emissions tests, members of the BWG conducted a literature search to obtain material characteristic data and emission test reports. Members reviewed attachments to ICR survey responses containing materials analysis information. Members also submitted test reports they indicated in the ICR were available and

provided additional test information and materials analysis data they had. One member is conducting an emissions test for bagasse-fired boilers. Members were able to reduce the number of materials for fuel sampling by 75%. The BWG believes that by analyzing the material characteristics data and the additional test reports the cost and scope for testing has been significantly reduced.

**COST:**

**Phase I: Materials -** $183,000 - 221,000
**Phase I: Emissions** - $820,000 - 1,070,000
**Phase II: Emissions** - $1,000,000 - 2,000,000

**SOURCE WORK GROUP NAME:** Combustion Turbines Work Group (CTWG)

**SOURCES/SUBCATEGORIES TO BE TESTED:** 5 combustion turbines (3 natural gas and 2 distillate oil-fired turbines)

**PURPOSE & NEED FOR TESTING:** A review of the combustion turbines emissions database indicates that additional emissions data are necessary to support the ICCR rulemaking development for this source category. Very little data are available in the emissions database on control technologies with the potential to reduce HAP emissions. Two test reports are available for turbines with lean pre-mix combustion systems, and one test report is available for a turbine with a CO oxidation catalyst system. Therefore, additional test data are needed to evaluate the HAP emission reduction effectiveness of these control systems. These test data will be used to establish emission standards for NESHAP regulations. Also, only a limited number of the tests in the emissions database were conducted at multiple operating loads. Therefore, test data are needed to more thoroughly evaluate the impact of load changes on HAP emissions.

**SUMMARY OF CURRENTLY AVAILABLE TEST DATA:** The combustion turbines emissions database contains test data from 70 source tests. Most of these source tests were conducted in the State of California as part of the AB 2588 program (Air Toxics "Hot Spots" Information Assessment Act of 1987). However, only two source tests were conducted on LPM combustion systems, and only one source test is available in the emissions database for a CO oxidation catalyst system.

**DATA GAPS TESTING WOULD FILL:** Test data are needed to provide the basis for MACT emission limitations and to determine the control effectiveness of CO oxidation catalysts and LPM combustion systems.

**ALTERNATIVES TO TESTING:** Based on catalyst vendor information, the CTWG is aware of some turbines equipped with CO oxidation catalyst systems. These turbine operators will be contacted to ascertain whether test data are available to determine the control effectiveness of these systems. If test data are not available for these systems, there are no alternatives but to conduct source tests to develop these data.

**DESCRIPTION OF COMBUSTION UNITS AND MATERIALS TO BE TESTED:** Five combustion turbines (3 natural gas and 2 distillate oil-fired turbines). Sizes of the combustion turbines: 1-10 megawatts (MW), 15-50 MW, and >70 MW for the three natural gas-fired turbines; 15-50 MW and >70 MW for the two distillate oil-fired turbines.

**NUMBER OF COMBUSTION UNITS AND TESTS:** For the three natural gas-fired turbines, two tests will involve stack sampling to characterize emissions from LPM combustors. The third natural gas-fired turbine test will require sampling at the inlet and outlet of a CO oxidation catalyst system. Two load conditions will be evaluated for each of these three turbines. Each test condition will require a set of 3 runs. Therefore, the LPM-related tests will involve two sets of

three runs; one set of three runs at each of the two load conditions. The CO oxidation catalyst-related test will involve four sets of three runs; two sets of three runs (inlet and outlet of the catalyst) at each load condition.

For the two distillate oil-fired turbines, sampling will be conducted at the inlet and outlet of the CO oxidation catalyst system on each turbine. Two load conditions will be evaluated for each of these two turbines. As discussed above for the natural gas-related tests, each test condition will require a set of 3 runs. Therefore, the tests will involve four sets of three runs; two sets of three runs (inlet and outlet of the catalyst) at each load condition. Also, if one of these turbines has water or steam injection, one test will be conducted with the water or steam injection turned off.

The CTWG will attempt to identify a cogeneration unit equipped with a duct burner for one of the five source tests described above. If this type of unit can be identified, sampling will be conducted at the inlet to the duct burner in addition to the sampling runs discussed above. Therefore, this test will involve two additional sets of three runs; one set of three runs at each of the two load conditions.

**POLLUTANTS TO BE TESTED:** See Table 1.

**LEVERAGING OF RESOURCES:** To reduce the number of tests, the CTWG will try to identify a natural gas-fired turbine employing LPM combustion and a CO catalyst system. If this type of turbine can be identified, the number of natural gas tests will be reduced from three to two. Also, stakeholder groups recently conducted a test of a turbine equipped with an oxidation catalyst system. Results from this test should be adequate for consideration by the CTWG.

**COST:** The estimated total cost for testing the five combustion turbines is $350,000.

TABLE 1. Pollutants to be Measured

| Pollutants | Test Methods** | Natural Gas | Distillate Oil |
|---|---|---|---|
| *Hazardous Air Pollutants (HAPs)* | | | |
| 2,2,4-Trimethylpentane | Method 18/TO-14 | X | X |
| Acetaldehyde | FTIR/CARB 430/EPA TO-11 | X | X |
| Acrolein | FTIR/CARB 430 | X | X |
| Arsenic Compounds* | Fuel Analysis (ASTM D5185) | X | X |
| Benzene | Method 18/TO-14/CARB 410A | X | X |
| Beryllium Compounds* | Fuel Analysis (ASTM D5185) | | X |
| Biphenyl | CARB 429 and 429 (m) | X | X |
| Cadmium Compounds* | Fuel Analysis (ASTM D5185) | | X |
| Chromium Compounds* | Fuel Analysis (ASTM D5185) | | X |
| Ethylbenzene | Method 18/TO-14/CARB 410A | X | X |
| Formaldehyde | FTIR/CARB 430/EPA TO-11 | X | X |
| Hexane | Method 18/TO-14 | X | X |
| Lead Compounds* | Fuel Analysis (ASTM D5185) | | X |
| Manganese Compounds* | Fuel Analysis (ASTM D5185) | | X |
| Mercury Compounds* | Fuel Analysis (ASTM D5185) | X | X |
| Methanol | Method 18/TO-14/Method 308 | X | X |
| Naphthalene | CARB 429 and 429 (m) | X | X |
| Nickel Compounds* | Fuel Analysis (ASTM D5185) | | X |
| PAH | CARB 429 and 429 (m) | X | X |
| Phenol | CARB 429 and 429 (m) | X | X |
| Styrene | Method 18/TO-14 | X | X |
| Toluene | Method 18/TO-14/CARB 410A | X | X |
| Xylene (total) | Method 18/TO-14/CARB 410A | X | X |
| *Criteria Pollutants* | | | |
| Carbon monoxide (CO) | EPA Method 10/FTIR | X | X |
| Oxides of nitrogen (NOx) | EPA Method 7E/FTIR | X | X |
| Particulate Matter (PM) | Method 5 | | X |
| Total Hydrocarbons (THC) | Method 25A | X | X |

TABLE 1 FOOTNOTES:

*To be measured using fuel sampling only .

**These are the test methods that have been recommended or that have been used to obtain emissions data on these pollutants. TMPWG guidance will be used to finalize the selection of test methods.

**SOURCE WORK GROUP NAME:** Incinerator Work Group (IWG)

**SOURCES/SUBCATEGORIES TO BE TESTED:** Drum reclaimer furnaces

**PURPOSE & NEED FOR TESTING:** IWG Subteam 4 has searched the EPA ICCR emissions database, trade group records, EPA technical documents, State agency resources, and State air permits that specify emission limits and could not find data to accurately characterize these units. As a result, Subteam 4 has concluded that there are insufficient emissions data available to accurately characterize these units.

**SUMMARY OF CURRENTLY AVAILABLE TEST DATA:** The ICR survey did not identify any HAPs emission data for drum reclamation furnaces. The Association of Container Reconditioners has found a single reference for some Section 129 pollutants. No data exist to characterize small drum furnaces.

**DATA GAPS TESTING WOULD FILL:** Subteam 4 has identified the following key emissions data gaps:

1. Insufficient data to characterize most Section 129 pollutants.
2. Unknown effect of furnace differences on emissions, including size and age of the unit.
3. Unknown effectiveness of possible MACT control devices.

**ALTERNATIVES TO TESTING:** Since insufficient data exist to determine either a numerical emission limit or a percent reduction, the only alternative to testing would be to "estimate" a MACT standard based on engineering judgement or experience with other similar facilities.

**DESCRIPTION OF COMBUSTION UNITS AND MATERIALS TO BE TESTED:** Typically these units are semi-continuous, natural gas fired tunnel furnaces equipped with afterburners. Process rates range from 40 to 500 55-gal drums per hour. Container residues may include hazardous materials. The units to be tested would be operated at or near the maximum rated/permitted capacity and would utilize a thermal oxidizer. Operating conditions would be representative of normal operating conditions. The following testing priorities are proposed:

**Priority 1** -- A natural gas fired drum furnace with a thermal oxidizer running approximately 300 drums per hour (over 10 years of age)

**Priority 2** -- A natural gas fired furnace with a thermal oxidizer running less than 200 drums per hour (any age; small business)

**Priority 3** -- A natural gas fired furnace with a thermal oxidizer running 300 or more drums per hour (less than 10 years of age)

**NUMBER OF COMBUSTION UNITS AND TESTS:** Subteam 4 proposes to test three

drum reclamation furnaces for all Section 129 pollutants.

**POLLUTANTS TO BE TESTED:** All Section 129 pollutants.

**LEVERAGING OF RESOURCES:** The Association of Container Reconditioners would act as a liaison between EPA and the test facilities.

**COST:** Subteam 4's preliminary estimate for the three emissions tests proposed, data analysis, and data reporting is about $300,000.

**SOURCE WORK GROUP NAME**: Incinerator Work Group (IWG)

**SOURCES/SUBCATEGORIES TO BE TESTED:** Industrial wastewater sludge and solid waste incinerators.

**PURPOSE AND NEED FOR TESTING:** A review of the survey and emissions databases indicates that additional emissions data are necessary to support a Section 129 rulemaking for miscellaneous industrial and waste incineration units. In particular, there are currently no data on dioxin emissions or controls in the databases, and our only source of dioxin information is the EPA Dioxin Primer. Dioxin is a Section 129 listed air pollutant which must have a specific emission limit.

**SUMMARY OF CURRENTLY AVAILABLE TEST DATA:** There are 15 units in the inventory database that incinerate wastewater sludge. Of these 15 units, 14 were surveyed for testing results. No data were available on dioxin emissions or control equipment effectiveness in removing dioxins from flue gases. Based on data provided by the EPA Dioxin Primer, these units may have a high potential for dioxin emissions based on the following factors that may potentially contribute to dioxin formation:

1. The feed to the unit contains complex organics.
2. There is entrained PM.
3. The units have PM controls.
4. The feed to the unit contains metals and chlorine.
5. The temperature to the PM control device is itself controlled.
6. These units can have heat recovery.

There are 138 facilities in the ICCR population database that incinerate non-wastewater, industrial solid waste. Of these 138 units, 73 were surveyed for testing results. No data were available on dioxin emissions or control equipment effectiveness from the flue gases of the incinerators in this category. Based on data provided by the EPA Dioxin Primer, these units may have a high potential for dioxin emissions, based on the same six factors listed above for the incineration of wastewater sludge.

**DATA GAPS TESTING WOULD FILL:** There are no data on dioxins in the ICCR databases.

**ALTERNATIVES TO TESTING:** An alternative to testing would be the adoption of a current standard such as those for the medical waste or municipal solid waste combustor MACTs.

**DESCRIPTION OF COMBUSTION UNITS AND MATERIALS TO BE TESTED:** Tests would be conducted on stack emissions from the incineration of industrial wastewater sludges and the incineration of non-wastewater industrial solid waste to determine the effectiveness of

add-on controls. The primary test would be for dioxin. However, stack tests for all 129 pollutants will be conducted. The primary purpose of the tests would be to determine the effectiveness of add on controls in controlling dioxin emissions.

**NUMBER OF COMBUSTION UNITS AND TESTS:** Tests would be conducted on one unit burning industrial wastewater solid waste. This unit would have particulate controls that make it representative of a controlled unit. In order to be representative of the entire category, the wastewater going to the wastewater treatment plant that produces the sludge would contain halogenated and metal components. It is also proposed that the testing of this incinerator be coordinated with the Boiler Work Group's testing of boilers burning sludges.

Tests would also be conducted on three units burning industrial non-wastewater solid waste. Tests would be conducted on units controlled for particulates. The selection of units to be tested would be based on an analysis of the feed to the unit, the particulate control device, and the use of a temperature quench system.

**POLLUTANTS TO TESTED**: Concurrent tests would be conducted for all Section 129 pollutants at the inlet and outlet of the air pollution control device. The waste streams would also be characterized for chlorine and metal content. This can be accomplished through testing or an engineering analysis of the feed.

**LEVERAGING OF RESOURCES:** Testing can be coordinated with companies already doing testing in support their Title V program. In this way costs can be shared with the company doing the testing.

**COST:** It is estimated that the total cost for the testing program would be between $600,000 and $700,000.

**SOURCE WORK GROUP NAME:** Incinerator Work Group (IWG)

**SOURCES/SUBCATEGORIES TO BE TESTED:** Metal parts reclaimer burnoff units.

**PURPOSE & NEED FOR TESTING:** Reviews of the survey and emissions databases indicate that additional emissions data are necessary to support rulemaking development for metal parts reclaimer burnoff units. The emission test database has not a single entry for metal parts reclaimer burnoff units, while the survey database indicates the existence of very limited emissions data, mostly for PM and CO. Clearly, additional emissions data are needed in order to establish numerical emission limits for the nine Section 129 pollutants.

**SUMMARY OF CURRENTLY AVAILABLE TEST DATA:** IWG Subteam 4 has subcategorized metal parts reclaimer units into three groupings, electrical winding reclaimer burnoff units, polyvinyl chloride (PVC)-coated metal parts reclaimer burnoff units, and non-PVC-coated metal parts reclaimers burnoff units, to facilitate identification of existing test data. Based on review of the survey database, existing emission test data points for the nine Section 129 pollutants are as follows:

| POLLUTANT | ELECTRICAL WINDINGS | PVC-COATED PARTS | NON-PVC-COATED PARTS | TOTAL |
|---|---|---|---|---|
| Carbon monoxide | 14 | 0 | 4 | 18 |
| Lead | 1 | 0 | 0 | 1 |
| Nitrogen oxides | 7 | 0 | 3 | 10 |
| Particulate matter | 12 | 0 | 7 | 19 |
| Sulfur dioxide | 4 | 0 | 3 | 7 |
| Cadmium | 1 | 0 | 0 | 1 |
| Dioxins | 2 | 0 | 0 | 2 |
| Hydrogen chloride | 3 | 0 | 0 | 3 |
| Mercury | 1 | 0 | 0 | 1 |

Clearly, most of the Section 129 pollutant emission test data are for electrical winding reclaimer burnoff units. Finally, independent of the survey database, the IWG possesses incomplete, old (1973) emissions data for hydrogen chloride emissions from one PVC-coated metal parts reclaimer burnoff unit. The hydrogen chloride emissions were measured to be 38 pounds per 1000 pounds charged (approximately one 8-hour batch). In addition, more recent (1990)

particulate matter emissions stack test data exist for the same burnoff unit located in Dayton, Ohio (three-run average = 54.9 mg/dscm @ 7% $O_{2,}$ or 0.090 pounds per hour). In summary, reliable, recent, Section 129 pollutant emission data for PVC-coated and non-PVC-coated metal parts reclaimer burnoff units are at best extremely limited.

**DATA GAPS TESTING WOULD FILL:** Due to the large amounts of chlorine present in PVC, published ambient PCDD/PCDF data, and operational conditions, Subteam 4 expects that hydrogen chloride and dioxins are emitted from PVC-coated metal parts reclaimer burnoff units. For PVC-coated and non-PVC-coated metal parts reclaimer burnoff units, no emissions data exist for metals, hydrogen chloride, and dioxins. Testing would allow establishing numerical emission limits for these pollutants as required under Section 129.

**ALTERNATIVES TO TESTING:** Conceivably a materials balance approach could be employed to estimate hydrogen chloride emissions from PVC-coated metal parts reclaimer burnoff units. Natural gas combustion emission factors could be used to estimate emissions of NOx, due to the fact that most NOx emissions would not be expected to be fuel-derived. However, for the other Section 129 pollutants, especially dioxins, there appears to be no alternative to stack testing. Six samples of cured coatings pyrolyzed in non-PVC-coated metal parts reclaimer burnoff units will be submitted under the Boiler Work Group materials testing program. This should provide direction for further stack testing recommendations (e.g., whether a materials balance approach might work for some pollutants, or whether testing for some pollutants is needed).

**DESCRIPTION OF COMBUSTION UNITS AND MATERIALS TO BE TESTED:** Most metal parts reclaimer burnoff units are small natural gas-fired batch units equipped with afterburners. A few may be equipped with wet scrubbers or fabric filters. They are often only differentiated based on the type of parts they are used to reclaim. Many non-PVC-coated parts reclaimer burnoff units burn off cured coatings from paint hooks and racks. Other non-PVC coatings include rubber, nylon, and polyethylene. Electrical winding reclaimer burnoff units burn off transformer cores or electric motor windings. Transformer dielectric fluid may contain PCBs. Electric motor windings are generally coated with a clear, nonpigmented varnish. A small number (estimated 30 to 50) of units burn off plastisol-coated electroplating racks. Plastisol is a suspension of PVC in a phthalate plasticizer. Plastisol serves as a tough, temperature- and chemical-resistant dielectric on the surface of the metal electroplating racks.

**NUMBER OF COMBUSTION UNITS AND TESTS:** Given the similarity of design and operation of most metal parts reclaimer burnoff units, a relatively small number of emission tests are required to allow establishing reasonable Section 129 pollutant emission limits. At a minimum, complete Section 129 pollutant testing is recommended for two PVC-coated metal parts reclaimer burnoff units and two non-PVC-coated metal parts reclaimer burnoff units. Due to the existence of Section 129 pollutant emission data for electrical winding reclaimer burnoff units, no additional testing for this type of unit is recommended at this time.

**POLLUTANTS TO BE TESTED:** Subteam 4 recommends concurrent outlet-only testing for the entire set of Section 129 pollutants - particulate matter, carbon monoxide, sulfur dioxide, nitrogen oxides, lead, hydrogen chloride, dioxins, cadmium, and mercury.

**LEVERAGING OF RESOURCES:** Local Ohio air agency staff (i.e., RAPCA) can provide stack test observers to ensure conformance to U.S. EPA Reference Methods at one PVC-coated metal parts reclaimer burnoff unit and two non-PVC-coated metal parts reclaimer burnoff units.

**COST:** Outlet-only testing for the nine Section 129 pollutants (per unit) is estimated to be about $65,000. This value is based on taking 1/8th of the stack test cost estimate provided by the Boiler Work Group (BWG) in their posted document "bwgtest.wpd." A factor of 8 is based on one test condition rather than the BWG's four, and outlet only testing rather than the BWG's inlet and outlet testing. Cost estimates may need to be adjusted based on the methods used. The total cost for four tests would be about $260,000.

**SOURCE WORK GROUP NAME:** Incinerator Work Group (IWG)

**SOURCES/SUBCATEGORIES TO BE TESTED:** Pathological waste incinerators and crematories.

**PURPOSE & NEED FOR TESTING:** To show the effect that varying ratios of non-tissue pathological waste and up to 30% "other" waste have on emission levels of Section 129 pollutants from human crematories and three distinct classes of pathological incinerators. The "other" waste feed may include hospital, medical, infectious, or pharmaceutical wastes.

This information is needed to verify the following assumptions: (a) emissions among human crematories and all of the pathological waste incinerators are sufficiently similar that they can be treated as one subcategory for regulatory development, (b) pollution prevention in the form of limits on waste feed content is a viable regulatory alternative, and (c) emissions from these incinerators have distinct differences from other classes of incinerators that have previously been the subject of regulatory development. In addition, the purpose is to help evaluate the impact of operating parameters on emissions to determine whether equipment design and parameters can provide sufficient reductions of emissions or if add-on controls will be necessary for MACT development. Finally, the information can be used as a basis for estimating reductions in emissions for various regulatory alternatives for the purpose of economic analysis.

**SUMMARY OF CURRENTLY AVAILABLE TEST DATA:** Limited test data for Section 129 criteria pollutants may be available. However, no consistent data under known test conditions, including waste feed, are available for all Section 129 pollutants, except as follows: one test for a human crematorium using California Air Resources Board methods and two tests from the EPA on a medical waste incinerator burning greater than 95% animal tissue. Test reports have been requested as referenced in the ICCR emissions and survey databases, but so far none have been received. It is unlikely, however, that useful data will be obtained from these requests. In addition, other test reports reviewed have not clearly identified waste streams or the technology of the test methods utilized. In summary, the emissions information reviewed thus far has not been shown to be consistent, complete, and compatible with EPA methods and test procedures.

**DATA GAPS TESTING WOULD FILL:** The data are needed to fill in gaps of information necessary to establish existing emission levels and also to suggest how emissions levels may be reduced by variations in operating characteristics and feed materials as a basis for MACT emission limitations.

**ALTERNATIVES TO TESTING:** State permit levels are non-existent for Section 129 HAPs and will not be helpful in the development of MACT standards. We are unaware of any other sources of data.

**DESCRIPTION OF COMBUSTION UNITS AND MATERIALS TO BE TESTED:** Units that are expected to be representative of all the units in the subcategory will be selected for testing. For the under 100 lb/hr group, the unit tested will be of a single-chamber design. Non-tissue wastes will be those materials normally burned that are expected to give the highest emission levels.

**NUMBER OF COMBUSTION UNITS AND TESTS:** Four units total -- two representative retort design units in the 100 to 500 lb/hr grouping; one representative multi-chamber design unit in the greater than 500 lb/hr grouping; and one representative single chamber, under 100 lb/hr unit. There are a maximum of nine tests recommended, each test consists of three sampling runs (see attached Matrix of Test Conditions).

**POLLUTANTS TO BE TESTED:** All the 129 pollutants in every testing scenario. The largest data gap is for dioxins/furans, which are the most expensive pollutants to sample. However, sampling for the remaining 129 pollutants would be worth the additional cost. In addition, one Subteam 1 member feels, in view of the now recognized toxicity of some of the polyaromatic hydrocarbons (PAHs) and their persistence in the environment, that PAH emissions should be part of these proposed incinerator test plans.

**LEVERAGING OF RESOURCES:** Subteam 1 members can attempt to identify units to test and help prepare the test plan.

**COST:** Based on $70,000 per test for all the 129 pollutants, the total cost is estimated to be about $630,000 for all nine tests.

MATRIX OF TEST CONDITIONS
*Pathological Waste Incinerators and Crematories*

| Combustor characteristics | >500 lb/hr; multi-chamber; animal incinerator; 1 sec. ret. time; 1800°F sec. chamber temp. | | | 100-500 lb/hr; retort; human crematory; 1 sec. ret. time; 1600°F sec. chamber temp. | | 100-500 lb/hr retort; animal incinerator; 1 sec. ret. time; 1600°F sec. chamber temp. | | <100 lb/hr; single chamber; poultry incinerator; standard operating cond. | |
|---|---|---|---|---|---|---|---|---|---|
| Test case # | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| Priority (A is highest) | **C** | **A** | **A** | **A** | **A** | **B** | **B** | **C** | **D** |
| % of tissue by mass | 70 | 30 | 30 | 80-90 | 50-60 | 90 | 60 | 100 | 90 |
| % of bedding/ container by mass | 20 | 60 | 40 | 10-20[1] | 40-50[2] | 10 | 10 | 0 | 0 |
| % of other feed by mass[3] | 10 | 10 | 30 | 0 | 0 | 0 | 30 | 0 | 10 |

[1]Cardboard cremation container weighing approximately 15 lb.
[2]Cremation container with wood, cloth, and/or cardboard, typically 40 to 100 lb.
[3]The "other" feed material will be determined.

**SOURCE WORK GROUP NAME:** Reciprocating Internal Combustion Engines WG

**SOURCES/SUBCATEGORIES TO BE TESTED:** Four subcategories will be tested:

- Spark ignited natural gas-fired two stroke lean burn engines
- Compression ignited liquid fuel (diesel fired) engines
- Spark ignited natural gas-fired four stroke lean burn engines
- Spark ignited natural gas-fired four stroke rich burn engines

**PURPOSE & NEED FOR TESTING:** The RICE Work Group has identified the following possible goals for emissions testing under the ICCR:

1. Acquire additional emissions data that can assist the Work Group in determining the effectiveness of after-treatment control devices to reduce formaldehyde and other HAPs;

2. Acquire additional emissions data that can assist the Work Group in determining the effectiveness of combustion modifications to reduce formaldehyde and other HAPs;

3. Acquire additional emissions data that can assist the Work Group in determining typical emissions for engines throughout the operating range.

The Work Group has designed the emissions test plan around Goal #1, for the following reasons:

- Emissions data to demonstrate the effectiveness of possible MACT control devices for existing RICE is a data gap in the ICCR Emissions Database for RICE. (see **Appendix A of the Test Plan**)

- Understanding of the effects of combustion modifications on HAPs is in its infancy, and would require a very extensive research program to identify potential control techniques, along with confirming testing.

- EPA has endorsed the use of ICCR emissions testing dollars to achieve this goal.

In addition, the Work Group has further focused the plan to address the effectiveness of after-treatment control devices on formaldehyde emissions, primarily, and on other HAPs, secondarily. The Work Group will gather emissions data for all HAPs included on the target list of pollutants. However, the control devices to be tested were selected principally for their potential to reduce formaldehyde emissions. The Work Group has added this focus to the test plan for the following reasons:

- Formaldehyde is a product of incomplete combustion and generally is the HAP emitted in the greatest quantities from RICE.

- The Work Group was able to identify possible maximum achievable control technology (MACT) for formaldehyde based on the results of emissions testing conducted by industry. There is less understanding of possible MACT for other HAPs.

The test plan also will support Goal #3 in part, since pre-controlled emissions throughout a 16-point test matrix of operating conditions will be recorded during the testing program.

**SUMMARY OF CURRENTLY AVAILABLE TEST DATA:** The Emissions Subgroup of the RICE WG reviewed the emissions data in the EPA ICCR Emissions Database for RICE, and determined the emission levels reported were highly variable. The Subgroup speculated that the variability could be attributed to 1) interferences associated with certain test methods or 2) the operating conditions of the engines when tested. In addition, many of the test reports lacked key information about engineering and operating parameters that could affect HAP emissions, such as makes, models, engine types, horsepower rating, speed, and air to fuel ratio. The RICE WG has also identified a need for data regarding the effectiveness of possible MACT control devices in reducing HAP emissions. Although there are some data in the database for before and after control, the data for NSCR correspond to a limited number of pollutants and high detection limits, and the data for oxidation catalysts include only a small number of pollutants measured both before and after controls. A representative control efficiency cannot be determined with the data currently available.

**DATA GAPS TESTING WOULD FILL:** The RICE WG has identified the following key emissions data gaps:

1. The effect of operating conditions on emissions, including:

- Air to fuel ratio sensitivity
- Speed and load
- Air manifold temperature
- Jacket water temperature
- Injection or spark timing sensitivity
- Engine balance sensitivity

2. The effectiveness of possible MACT control devices in reducing HAP emissions, including oxidation catalysts and NSCR.

**ALTERNATIVES TO TESTING:** The alternative to testing would be to set a MACT floor based on an equipment standard, since not enough data are available to determine either a numerical emission limit or a percent reduction.

**DESCRIPTION OF COMBUSTION UNITS AND MATERIALS TO BE TESTED:**

- 2-stroke lean burn natural gas engine with oxidation catalyst: Cooper Bessemer GMV4-TF

- 4-stroke lean burn natural gas engine with oxidation catalyst: Waukesha 3521 GL

- 4-stroke rich burn natural gas engine with NSCR catalyst: White Superior 6G825

- 4-stroke diesel engine with oxidation catalyst: Caterpillar 3508 "interim"

**NUMBER OF COMBUSTION UNITS AND TESTS:** Four combustion units will be tested. The WG has developed a 16-point test matrix of operating conditions to be tested. These are listed below:

- Four corners of the torque/speed envelope (runs 1-4)
- Air to fuel ratio sensitivity (runs 1, 5-6)
- Speed and load (run 7)
- Air manifold temperature (run 8)
- Jacket water temperature (runs 1, 11-12)
- Injection or spark timing sensitivity (runs 13-14)
- Engine balance sensitivity (runs 1, 15-16)

**POLLUTANTS TO BE TESTED:** Emissions data for the following criteria pollutants will be collected:

- Carbon monoxide (CO)
- Nitrogen oxides (NOx)
- Total hydrocarbons (THC)
- Particulate matter (PM) (diesel only)

Ten hazardous air pollutants are included in the test plan for all engines, regardless of fuel:

- BTEX (benzene, toluene, ethylbenzene, and xylene)
- Three aldehydes (formaldehyde, acetaldehyde, and acrolein)
- Naphthalene
- 1,3-butadiene
- PAHs

In addition, n-hexane and metals are included for diesel fuel.

**LEVERAGING OF RESOURCES:** Gas Research Institute and PRC International have agreed to cover some of the costs of the testing program. This is projected to be $200,000.

Engines have been provided by industry at no cost to the testing program.

**COST:** The Testing and Monitoring WG estimates that the four emissions tests proposed, data analysis and data reporting will cost $870,000, $200,000 of which Gas Research Institute and PRC International will provide. (This is a preliminary estimate.)